CLAIMS

1. A single crystal diamond grown by vapor phase synthesis, wherein when one main surface is irradiated with a linearly polarized light considered to be the synthesis of two mutually perpendicular linearly polarized light beams, the phase difference between the two mutually perpendicular linearly polarized light beams exiting another main surface on the opposite side is, at a maximum, not more than 50 nm per 100 μm of crystal thickness over the entire crystal.

2. The single crystal diamond according to Claim 1, wherein the single crystal diamond has a thickness of at least 100 μm and not more than 1500 μm.

3. The single crystal diamond according to Claim 1 or 2, wherein the single crystal diamond has a resistivity of at least 10^{12} $\Omega \cdot$cm at room temperature.

4. The single crystal diamond according to any of Claims 1 to 3, wherein the spin density obtained by electron spin resonance is not more than $1 \times 10^{17}/cm^3$ at room temperature within a g value range of at least 2.002 and less than 2.0028.

5. The single crystal diamond according to any of Claims 1 to 4, wherein the concentration of nitrogen atoms contained as an impurity is from 0.01 to 100 ppm.

6. The single crystal diamond according to any of Claims 1 to 5, wherein the concentration of silicon atoms contained as an impurity is from 0.01 to 1000 ppm.

7. The single crystal diamond according to any of Claims 1 to 6, wherein the single crystal diamond has a

half-width between 10 and 80 seconds in an X-ray rocking curve in a (400) plane over an entire crystal, and has, as impurities, a concentration of hydrogen atoms between 10 and 100 ppm and a concentration of nitrogen atoms between 0.01 and 100 ppm.

8. The single crystal diamond according to Claim 7, wherein the concentration of hydrogen atoms as an impurity is from 20 to 70 ppm.

9. The single crystal diamond according to any of Claims 1 to 8, wherein the single crystal diamond has a thermal conductivity of at least 2000 W/m·K at room temperature.

10. The single crystal diamond according to any of Claims 1 to 9, wherein the single crystal diamond has a hole mobility of at least 1500 $cm^2/V \cdot sec$ at room temperature.

11. The single crystal diamond according to any of Claims 1 to 10, wherein the single crystal diamond has an electron mobility of at least 1500 $cm^2/V \cdot sec$ at room temperature.

12. The single crystal diamond according to any of Claims 1 to 11, wherein a peak appearing at a Raman shift of 1332 cm^{-1} in Raman spectroscopy has a half-width of not more than 2 cm^{-1}.

13. The single crystal diamond according to any of Claims 1 to 12, wherein surface etch pits appearing as a result of hydrogen plasma treatment are present in a quantity of not more than 1×10^5 per square centimeter.

14. The single crystal diamond according to any of Claims 1 to 13, wherein the number of crystal defects as

evaluated by light scattering tomography is not more than 1×10^5 per square centimeter.

15. The single crystal diamond according to any of Claims 1 to 14, wherein the single crystal diamond has a Young's modulus of at least 5×10^{11} Pa.

16. The single crystal diamond according to any of Claims 1 to 15, wherein the single crystal diamond has a diameter of at least 4 mm.

17. The single crystal diamond according to any of Claims 1 to 16, wherein the single crystal diamond has a diameter of at least 10 mm.

18. The single crystal diamond according to any of Claims 1 to 17, wherein the concentration of nitrogen atoms as an impurity is from 0.01 to 5 ppm.

19. The single crystal diamond according to any of Claims 1 to 18, wherein the single crystal diamond has a transmittance of at least 30% at a wavelength of 250 nm.

20. A semiconductor substrate comprising the single crystal diamond according to any of Claims 1 to 19.

21. An optical window comprising the single crystal diamond according to any of Claims 1 to 19.